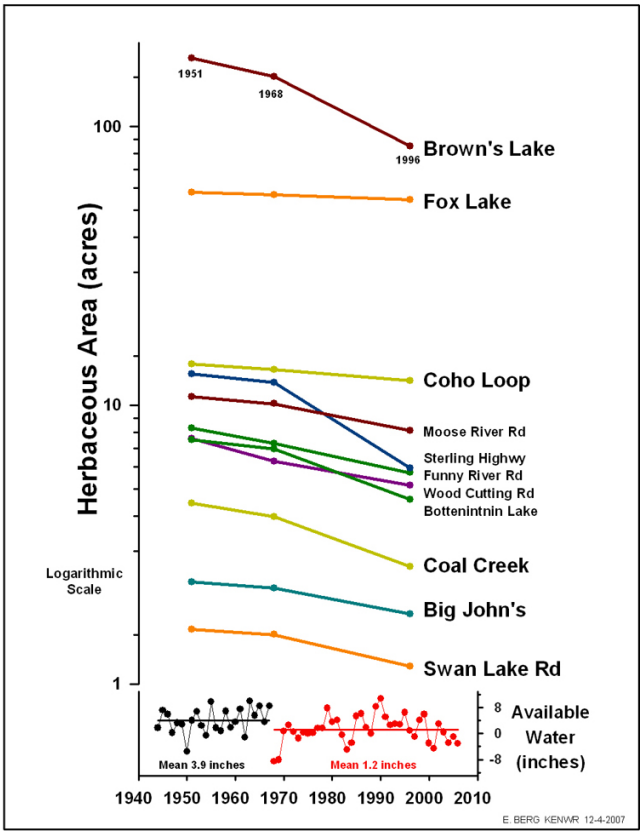
Historical aerial photographs show Kenai open wetlands shrinking at an accelerating rate

by Ed Berg with Kacy McDonnell



Graph shows the shrinkage of open herbaceous area (with no shrubs or trees) at eleven wetlands in the central Kenai Peninsula. The open areas of all these wetlands are shrinking, mostly at an accelerating rate. Note that the vertical scale reduces the larger areas. Lower panel shows the decline in available water (precipitation minus evapotranspiration), as calculated from Kenai airport weather data for 1944-2006. (Graph by Ed Berg)

I always enjoy looking at old family photo albums to see the pictures of how my kinfolk and I have changed over the ever-accumulating decades of our lives. Time and tide wait for no man, and these family photos show the inexorably flight of time's arrow through the generations of our family.

Time's arrow also passes over the landscapes on which we dwell, although the photo album may not be so easy to view. On the Kenai we are privileged to have aerial photography dating back to the early 1950s. A second set of aerial photos covers the central Peninsula in 1968, and the entire Kenai was photographed in 1996.

The most noticeable change recorded on these photos is the spread of human infrastructure: the roads, subdivisions, and logged areas. The human footprint is large indeed, and reflects the Peninsula population growth rate of 2.2% per year, a doubling of people every 30 years or so. But beyond the expanding human footprint there are more subtle changes occurring on the landscape. Much of the forest has turned grey from spruce bark beetle mortality, although the forest is now greening up with more hardwoods and thriving young spruce.

The aerial photos also show a drying landscape, especially between 1968 and 1996. Many ponds have vanished since 1968, and closed basin lakes have shrunk, exposing a "bath tub" ring of naked shoreline. A halo of small black spruce around wetlands shows that the forest edge is advancing into areas previously too wet for trees. We have counted tree-rings of these black spruce and found that the oldest ones were recruited at the end of the Little Ice Age in the 1850s.

Most striking is the shrub invasion of the wetlands. Small shrubs like dwarf birch, Labrador tea, and sweet gale have proliferated over wide expanses of muskeg. We have counted tiny tree-rings in dwarf birch stems at three sites, and found that they are generally quite young, mostly dating back to the 1970s.

As part of our studies of landscape drying on the Kenai we worked with graduate student Kacy McDonnell and professor Roman Dial at Alaska Pacific University to do a comparative study of wetland shrinkage on the aerial photos of 1951, 1968 and 1996. We have digitized all of these photos so that they can be viewed on a computer. The photos are spatially synchronized so that it is possible to precisely overlay them on the computer, as if they were plastic films.

For eleven wetlands Kacy was able to draw a line on each photo (on the computer screen) around the edge of the wetland, demarcating the boundary

between woody vegetation (trees and shrubs) and open herbaceous vegetation (grasses, sedges, and peat moss). Once the line was drawn around the wetland, the computer calculated the area enclosed by the line. This process was repeated on aerial photos from 1951, 1968 and 1996, and the areas were compared (see graph). Kacy examined wetlands ranging from a few acres to several hundred acres. In all cases the open herbaceous area was shrinking. Furthermore, in most cases the rate of shrinkage increased after 1968.

Strictly speaking, these graphs do not represent wetland loss. The wetlands are drying out and becoming shrubby and forested, but they are still wet, at least part of the year. The Corps of Engineers would still classify them as wetlands (and you would still need a construction permit) because of the hydric soils, high water table, and presence of many obligate wetland plant species, like Sphagnum moss.

The drying wetlands are a result of our warming Alaska climate. The warmer summers increase evaporation from the soil and transpiration from plants (evapotranspiration). One measure of this drying is the "available water," which is the difference between precipitation and potential evapotranspiration. This is the water available for stream flow, groundwater recharge, and plant and animal growth. It is the net profit, the "bottom line" in the water budget for an ecosystem.

According to the weather record from the Kenai airport since 1944, the long-term water balance took a dive during the drought of 1968-69 and never fully recovered. (Old timers will recall the 79,000-acre 1969 Kenai fire which burned the dried out vegetation right down to mineral soil, and promoted terrific birch regeneration and all-time moose highs for years).

For the Kenai airport, the average water balance for 1944-1967 was 3.9 inches of water; the average balance for 1968-2005 was 1.2 inches, down by 70%. This is a major decline. (See graph)

One practical consequence of the drying landscape is that wetlands that were fuel breaks in the past will become fuel bridges in the future, as they fill in with black spruce and grass. This continuity of fuels will allow wildfires to propagate more efficiently over larger areas. A warmer climate in general will probably promote more fire activity. On the other hand more fires will promote more hardwood browse production, which should promote more moose. One might say that this is a silver lining in the climate change cloud that may favor an important prey species in our local food chain.

Ed Berg has been the ecologist at the Kenai National Wildlife Refuge since 1993. Kacy McDonnell is a graduate student at Alaska Pacific University. She attended Soldotna High School and has a Bachelors Degree in Biology from University of Alaska Anchorage. Previous Refuge Previous Refuge Notebook columns can be viewed on the Web at http://www.fws.gov/refuge/kenai/.